USDA Forest Service Research Note SE-133 July 1970

DISKING AND PRESCRIBED BURNING: SIXTH-YEAR RESIDUAL EFFECTS ON LOBLOLLY PINE AND COMPETING VEGETATION

Abstract.--In the Virginia Coastal Plain, the effects of disking and of three series of prescribed burns on crown coverage and height of regenerating loblolly pine (Pinus taeda L.) and competing hardwoods and shrubs were compared after 6 years. One winter burn followed by three annual summer burns just before harvesting was the site preparation most effective in reducing hardwood competition. Space not occupied by sprouting hardwoods and shrubs was captured by pine regeneration.

Preparing sites for regenerating loblolly pine (Pinus taeda L.) in the Virginia and Carolina Coastal Plain requires the control of understory vegetation. Both heavy equipment and fire are used for this type of site preparation. Trousdell and Langdon[1] compared the effects of disking and prescribed burning on the establishment of loblolly pine and the growth of competing shrubs and small hardwoods through the fourth year after treatment. This Note presents the sixth-year results of the same study.

METHODS

The area selected was the former Camp Experimental Forest,[2] which lies on the broad divide between the Blackwater and Nottoway Rivers in Sussex and Southampton Counties, Virginia. Each of eight 40-acre plots of 60-year-old loblolly pines was subjected to one of four site preparations before logging: (1) one winter burn followed by one summer burn; (2) one winter burn followed by two annual summer burns; (3) one winter burn followed by three annual summer burns; and (4) disking. Disking was performed with a heavy-duty, 8-disk harrow pulled by an HD-9 or HD-11 tractor. All preparations were scheduled so that the disking and final summer burns occurred just prior to the harvest cuttings.

[1] Trousdell, K. B., and Langdon, O. G. Disking and prescribed burning for loblolly pine regeneration. J. Forest. 65: 548-551. 1967.

[2] The Camp Experimental Forest was maintained by the Southeastern Forest Experiment Station in cooperation with the Union Camp Corporation, Franklin, Virginia. The author gratefully acknowledges the assistance of the Union Camp Corporation and the Virginia Division of Forestry, Waverly, Virginia.

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The site preparations were replicated in two series of four plots each. The first series of plots was on flat topography and was poorly drained. Soils on these plots had surfaces of fine to very fine sandy loam and belonged to the Dunbar-Lenoir-Othello soil association. The second series of plots was on gently sloping topography at the headwaters of small streams. Soils on these plots had a surface of very fine sandy loam, were moderately well drained, and belonged to the Atlee-Craven soil association. The first series was logged prior to seedfall in 1958, and the second was logged prior to seedfall in 1959. Seed trees in the first replication were removed 2 years later, and those in the second were removed 3 years later. Residual hardwoods and pine whips were controlled with chemicals after the seed trees were harvested.

Fifty-eight line transects, each 10 links (6.6 feet) long, were randomly located in each of the eight plots, and the percentage of crown cover (crown area) was estimated separately for hardwoods, shrubs, and pines by the line-interception method. Heights of the tallest hardwood, shrub, and pine were also measured on each transect. An index of vegetational mass for each class of vegetation in the four site preparations was computed by multiplying the percentage of coverage times the average height of the tallest plants.

RESULTS AND DISCUSSION

Hardwoods and shrubs were principally of sprout origin. Red maple (Acer rubrum L.), blackgum (Nyssa sylvatica Marsh.), and sweetgum (Liquidambar styraciflua L.) made up about 60 percent of the hardwood stems; about half of this group was red maple. Sixteen percent of the stems were oaks (Quercus spp.), primarily of the white oak group, and the remaining 24 percent included a number of small understory species, such as sourwood (Oxydendrum arboreum (L.) DC.), flowering dogwood (Cornus florida L.), and American holly (Ilex opaca Ait.). Sweet pepperbush (Clethra alnifolia L.) was the dominant shrub in the first series of plots, and blueberry (Vaccinium spp.) and azalea (Rhododendron spp.) were the dominant shrubs in the second series.

After 6 years, only the hardwoods showed any significant differences in crown coverage or height among the four site preparations (table 1). Hardwood coverage was significantly less on sites subjected to three summer burns than on sites subjected to one summer burn. This was the only significant difference in hardwood coverage among the various preparations. Hardwoods were significantly taller on sites subjected to one summer burn than on sites subjected to either two or three summer burns. Hardwoods on disked sites were significantly taller than those on sites subjected to three summer burns. Other differences in hardwood heights were not significant.

Shrub coverage and heights were not significantly different among the various preparations. After 6 years, the pines were 5 to 6 feet taller

Table 1.--Average crown coverage and height of hardwoods, shrubs, and pines 6 years after site preparation

Site preparation	Crown coverage			Height[1]		
	Hardwoods	Shrubs	Pines	Hardwoods	Shrubs	Pines
	----Percent----			----Feet----		
One winter and one summer burn	29.6	66.9	28.9	6.9	3.1	8.4
One winter and two summer burns	25.3	53.7	44.3	5.4	2.9	8.0
One winter and three summer burns	17.7	44.1	50.3	4.6	2.8	8.8
Disking	21.5	59.8	39.5	6.6	2.7	8.4
Least significant difference at 5-percent level[2]	11.1	NS	NS	1.2	NS	NS

[1] Average height of tallest plant in each transect measured.
[2] Differences based on Tukey's Q test. NS indicates averages are not significantly different at the 5-percent level.

than the shrubs on all sites. This greater height of pines indicates that all site preparations adequately controlled early shrub competition.

Crown coverage and height of loblolly pines were estimated for the first time at 6 years. Neither of these measurements showed significant differences at the 5-percent level among the four preparations. Pines were taller than hardwoods on all sites, but not to the same degree. These differences in height dominance apparently resulted from the differences in height of the hardwoods on the various sites. For example, pines exceeded hardwoods in height by 1.5 feet on sites subjected to one summer burn, by 1.8 feet on disked sites, and by 4.2 feet on sites subjected to three summer burns. Obviously, the pines became dominant at an earlier age on sites where control of competition was greatest. Differences in pine coverage, although not significant at the 5-percent level, were significant at the 10-percent level when sites subjected to two summer burns, which had considerable variation between replications, were excluded from the analysis.

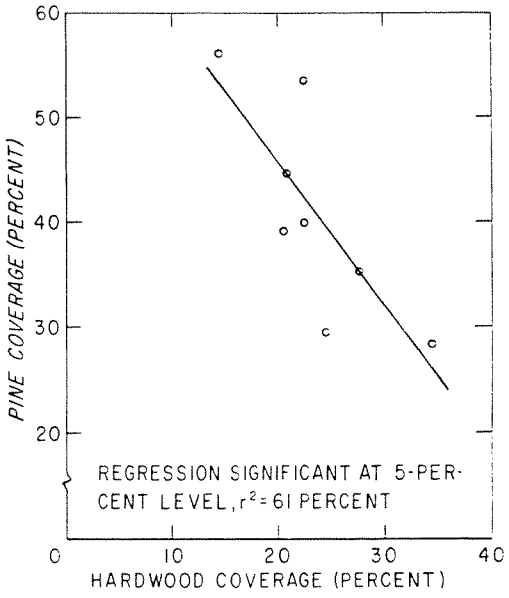

Figure 1.--Relationship of pine and hardwood coverages 6 years after site preparation.

Hardwood and pine coverages (fig. 1) were negatively correlated.

The greater the hardwood coverage, the less the pine coverage. Pine seedlings apparently capture space not occupied by hardwood sprouts. This relationship was also apparent from a comparison of the effects of each additional summer burn on the crown coverage and height of hardwoods and pines (fig. 2). Both hardwood height and coverage at 6 years

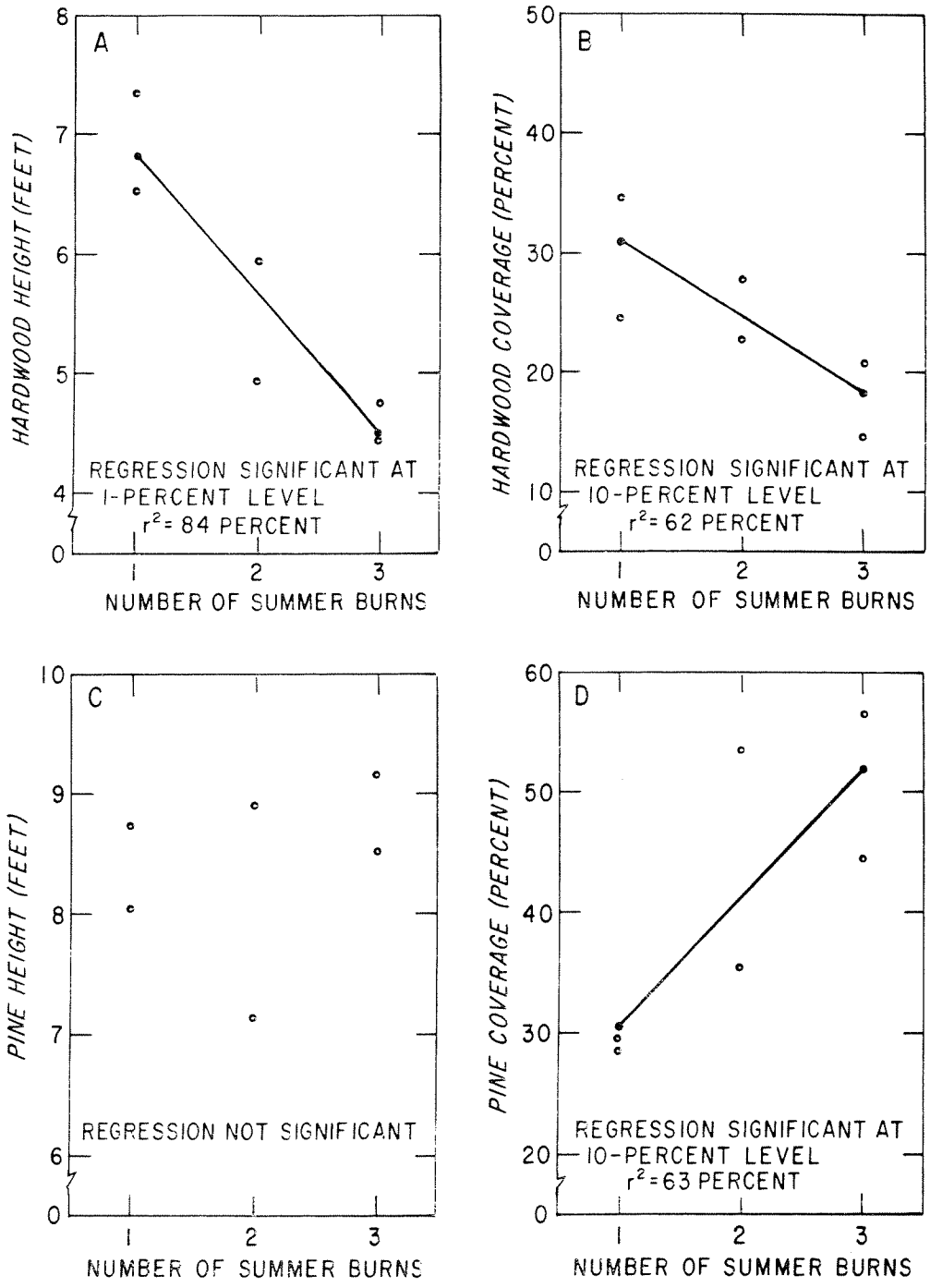

Figure 2.--The effects of the number of annual summer burns on (A) hardwood height, (B) hardwood coverage, (C) pine height, and (D) pine coverage.

were less with each additional burn. This overall effect probably resulted from the mortality of hardwood rootstocks and the reduced vigor of those sprouts that did not succumb.[3] Pine coverage increased as the number of summer fires increased, but pine heights were not significantly affected by additional burns.

The total accumulated indices of vegetational mass at 6 years were almost identical for each of the site preparations, indicating that the total mass produced on the various sites was nearly equal (fig. 3). Disked sites and those subjected to two summer burns were similar in composition of hardwoods, shrubs, and pines. Among the burned sites, each additional summer fire reduced the vegetational mass of hardwoods and shrubs but increased that of pine. The pine component of sites subjected to three summer burns was nearly double that of sites subjected to one summer burn.

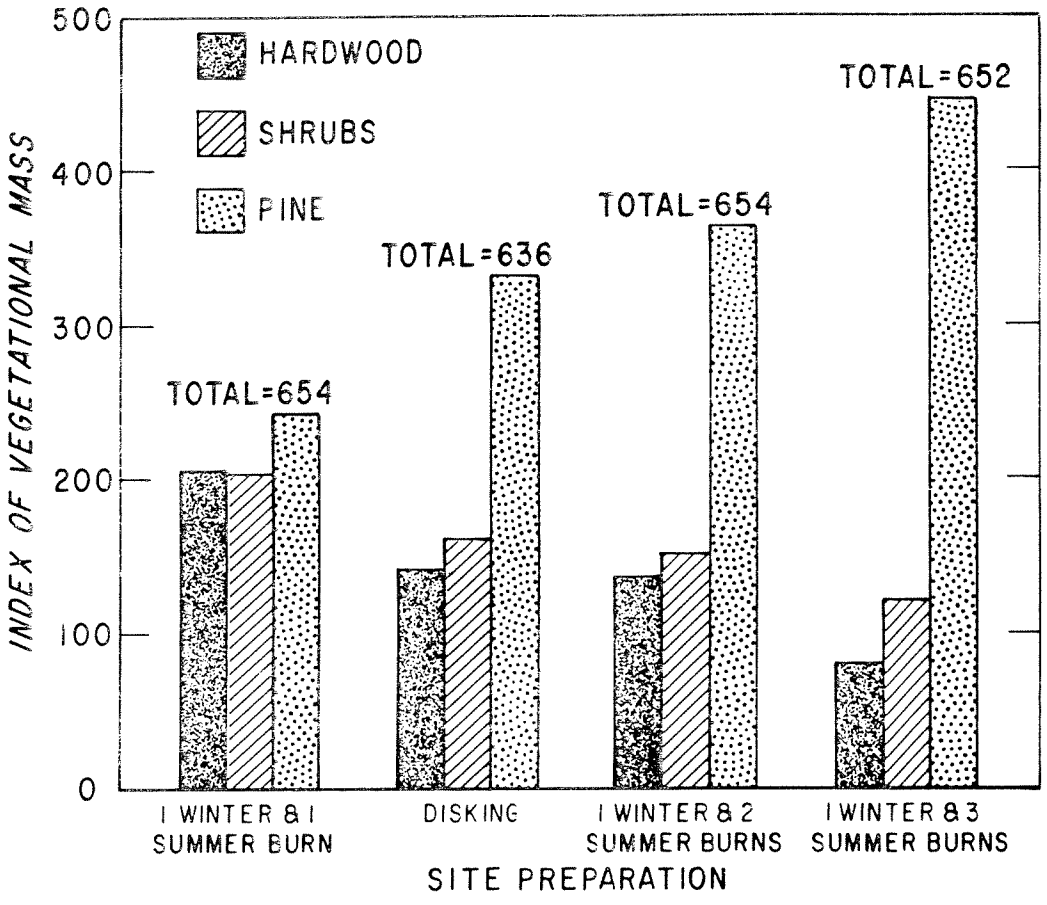

Figure 3.--Index of vegetational mass at 6 years for each class of vegetation in the four site preparations.

[3] Lotti, Thomas, Klawitter, R. A., and LeGrande, W. P. Prescribed burning for understory control in loblolly pine stands of the coastal plain. USDA Forest Serv. Southeast. Forest Exp. Sta. Pap. 116, 19 pp. 1960.

In summary, annual summer fires progressively reduce hardwood competition. After 6 years, there were significant differences in hardwood size and coverage among the various site preparations. One winter burn followed by three summer burns was the preparation most effective in reducing hardwood competition. The available evidence seems to support the thesis that loblolly pine reproduction captures space not occupied by hardwood sprouts.

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